IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/11/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background
IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do <u>not</u> assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 2/11/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

IEM's Modeling Lead
Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Connecticut State Projections
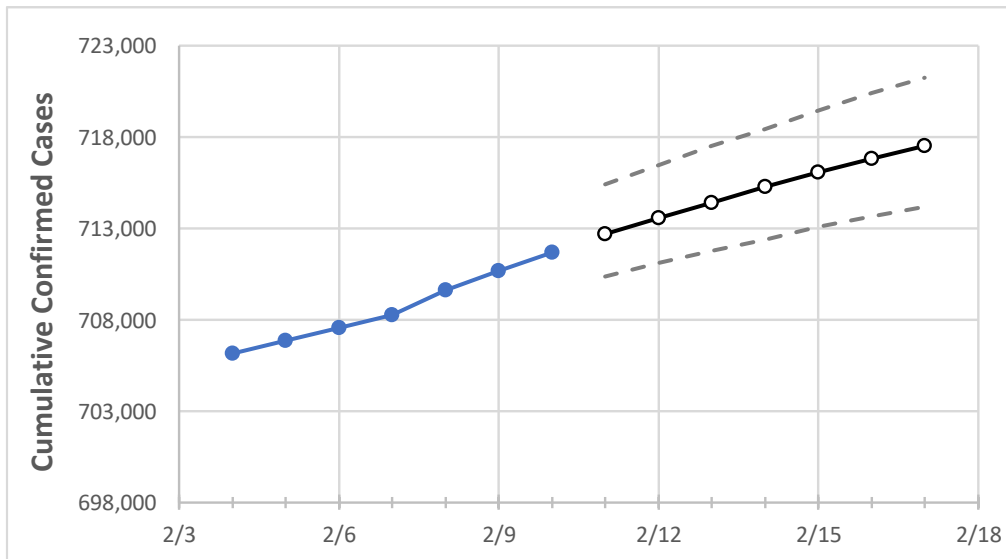
	Actual Confirmed Cases On:				Projected Cases For:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Connecticut	708,278	709,621	710,669	711,695	712,703	713,571	714,421	715,291	716,064	716,825	717,534

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Connecticut Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Fairfield	195,214	195,518	195,800	196,035	196,240	196,451	196,647	196,839	197,013	197,197	197,355
Hartford	171,352	171,694	171,920	172,170	172,383	172,576	172,760	172,939	173,100	173,265	173,409
Litchfield	30,349	30,411	30,474	30,525	30,573	30,617	30,660	30,701	30,741	30,778	30,813
Middlesex	26,349	26,408	26,464	26,527	26,574	26,619	26,661	26,703	26,744	26,782	26,822
New Haven	185,705	186,006	186,255	186,504	186,739	186,966	187,180	187,393	187,599	187,787	187,962
Tolland	19,591	19,647	19,690	19,722	19,766	19,810	19,851	19,891	19,928	19,969	20,003

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Connecticut Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	2/7	2/8	2/9	2/10	2/12	2/14	2/16
Fairfield	195,214	195,518	195,800	196,035	196,451 (39,290) [9,430] {4,715}	196,839 (39,368) [9,448] {4,724}	197,197 (39,439) [9,465] {4,733}
Hartford	171,352	171,694	171,920	172,170	172,576 (34,515) [8,284] {4,142}	172,939 (34,588) [8,301] {4,151}	173,265 (34,653) [8,317] {4,158}
Litchfield	30,349	30,411	30,474	30,525	30,617 (6,123) [1,470] {735}	30,701 (6,140) [1,474] {737}	30,778 (6,156) [1,477] {739}
Middlesex	26,349	26,408	26,464	26,527	26,619 (5,324) [1,278] {639}	26,703 (5,341) [1,282] {641}	26,782 (5,356) [1,286] {643}
New Haven	185,705	186,006	186,255	186,504	186,966 (37,393) [8,974] {4,487}	187,393 (37,479) [8,995] {4,497}	187,787 (37,557) [9,014] {4,507}
Tolland	19,591	19,647	19,690	19,722	19,810 (3,962) [951] {475}	19,891 (3,978) [955] {477}	19,969 (3,994) [959] {479}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.